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Description of Five New Species of Hawaiian Eulimidae

by

ANDERS WARÉN

Department of Zoology, Box 25059, S-400 31 Göteborg, Sweden

BEATRICE L. BURCH AND THOMAS A. BURCH

236 Kuuhoa Place, P.O. Box 309, Kailua, Oahu, Hawaii 96734

Abstract. Five new species of Hawaiian Eulimidae are described. *Trochostilifer* ***entospinea*** lives in galls in spines of *Chondrocidaris gigantea, T.* ***hawaiiensis*** in galls in the test of *Prionocidaris hawaiiensis; Vitreolina* ***hawaiiensis*** lives on the external surface of *P. hawaiiensis, V.* ***chondrocidaricola*** lives on and inside *Chondrocidaris gigantea,* and *Pelseneeria* ***hawaiiensis*** lives attached to the gonopores of *Aspidodiadema hawaiiensis* (all hosts Echinoidea). A second species of *Pelseneeria* is recorded, but not described, from *Stereocidaris hawaiiensis.*

INTRODUCTION

THE SPECIES OF THE family Eulimidae are almost exclusively parasitic on echinoderms and constitute a large group of gastropods in the tropical parts of the Indo-Pacific area. The species live as endo- or ecto-parasites, and many adaptations to a parasitic life are found in the group (WARÉN, in press). Comparatively few species are known from the Hawaiian Islands (KAY, 1979; WARÉN, 1980a, b, 1981), but scattered records in the literature (SCHOENBERG, 1980) and examination of museum collections show the diversity of the family to be much greater than presently known. We will here describe five new species that two of us (B.L.B. & T.A.B.) have found during offshore dredgings around the Hawaiian Islands.

The types and some additional specimens have been deposited in the U.S. National Museum, Division of Mollusks (USNM); the remaining specimens are in our collections.

Trochostilifer Warén, 1980

Type species: *Trochostilifer domus* Warén, 1980.

Remarks: Three species have previously been described in this genus. Two live in galls in the spines and one on the test of different cidaroid sea urchins (WARÉN, 1980b). The new species described below from *Chondrocidaris gigantea* was mentioned by WARÉN (1980b) but not described.

Trochostilifer ***entospinea***
Warén, B. Burch & T. Burch, spec. nov.

(Figures 3, 4, 5, 6, 8, 21)

Type material: Holotype, one female, USNM 792378; paratype, the male from the same gall, USNM 792379.

Type locality: From a gall in a spine of *Chondrocidaris gigantea* (A. Agassiz), 10 Feb. 1980, 21°25.8'N, 157°43.3'W, 18 m, Kailua Bay, Oahu, Hawaii (1 gall with one female 2.53 mm, 1 male 1.0 mm, no egg capsules).

Material examined: One single female, 2.40 mm high, no egg capsules, 9 Dec. 1979, 21°25.8'N, 157°43.3'W, 15 m, Kailua Bay, Oahu, Hawaiian Islands, in a gall in spines of *Chondrocidaris gigantea*; 1 spine from *Chondrocidaris gigantea* with 1 gall with a female, a male and egg capsules, 1 small, empty gall (Figure 8), 13 Jan. 1980, 21°28.0'N, 157°43.0'W, 23 m, Maku manu, Oahu, Hawaiian Islands, (spine saved intact); 1 spine with 1 female, 1.56 mm, 1 male, 0.80 mm, no egg capsules, 2 spines, each with a healed gall, no cavity or snail inside, 13 Jan. 1980, 21°26'N, 157°43'W, 15 m, Mokua Rock, Oahu, Hawaiian Islands; 1 spine with a gall containing 1 female, height 3.04 mm, 1 male (crushed) and a dozen egg capsules, 3 Feb. 1980, 1 very young specimen with less than half a postlarval whorl, in a small pit beside a gall, 21°19.5'N, 158°08.4'W, 15 m, Barbers Point, Oahu, Hawaiian Islands; 1 gall in a spine, from the type locality, serially sectioned into 10 μm sections, stained with Ehrlich's haematoxylin-eosin, containing 1 male, 1 female, several egg capsules, 1 very young specimen with less than one half postlarval whorl, found in a small pit on the outside of the same gall; 1 empty shell in shell sand, NW end of Lanai Island, Hawaiian Islands, 20°55'N, 157°03'W, 20 m, Los Angeles County Museum 74-67.

Description—Female: Shell small, grayish transparent, broadly conical with a flat base and mucronate larval shell. The larval shell (Figure 21) is 390 μm high and consists of about 3.2 distinctly convex whorls. The holotype has 3.5 slightly concave postlarval whorls with a faint shoulder just below the suture. The body whorl is abruptly rounded at the periphery and there is a well delimited basal surface. The sculpture consists of about 15 rather distinct spiral cords above the periphery and about 18 less distinct and slightly undulating spiral lines on the basal surface. There is also an axial sculpture of rather sharp incremental lines of varying strength, running all the way from the suture to the columella. The aperture is squarish with the lower part retracted rather far behind its upper parts. The outer lip is thin and very slightly flexuous (seen from the side).

Dimensions of holotype: Height of the shell 1.68 mm, maximum diameter 2.53 mm, minimum diameter 2.22 mm. (The dimensions of the aperture are irrelevant because they cannot be well defined.)

Male: Much smaller, up to 1.2 mm (approximate, specimen crushed), with up to 1.3 postlarval whorls. Its shell is more rounded and has a much less distinct sculpture than the female.

Anatomy: The quality of the fixation of the two adult specimens sectioned *in situ* in a spine did not allow any detailed examination of the anatomy, but it could be seen that the female has eyes, foot, large pedal folds, operculum and a large proboscis. The proboscis was buried in the tissues of the spine, *i.e.,* the wall of the gall. At this point the tissues of the spine had a much higher content of organic matter, judging from the higher absorption of the stain (Ehrlich's haematoxylin-eosin), than the other parts of the gall and the spine. Therefore, we assume that irritation by the parasite causes a wound-like growth zone here, which is used by the parasite. The precise way of feeding can only be determined when better fixed material is available.

Reproduction: The gall with the largest female (3.04 mm) contained about a dozen egg capsules. They are spherical, have a single, simple, smooth wall, a diameter of about 1 mm, and are attached by a short stalk. They contain 150–200 young each, in different stages of development. The diameter of uncleaved eggs is 100 μm, the height of the shell of the veliger larvae ready to hatch is 180 μm. Thus, the species has planktotrophic development because the height of newly settled larvae is 500 μm.

Remarks: The shape of the shell of *T.* ***entospinea*** resembles most closely that of *T. domus* Warén, 1980, but *T.* ***entospinea*** has a more distinctly angulated periphery than *T. domus* and also a more pronounced spiral sculpture. The other known species of *Trochostilifer* that live in galls have a much less distinct spiral sculpture and also flatter larval whorls. From *T.* ***hawaiiensis*** it can be separated by the rounder periphery and the less distinct spiral sculpture in that species.

Two spines (see material examined) had galls that evidently were in the process of healing. The outer shape and surface structure was typical for galls, but the cavity had been filled in with calcium carbonate of a slightly more spongy structure than the remaining parts of the spine. One gall contained 2 empty shells, without any visible damage, but no repair could be observed. These observations suggest that the parasite has a shorter life span than the host.

The first part of the postlarval shell in female *T.* ***entospinea,*** as in all other gall-producing species of *Trochostilifer* that have been examined, starts with about one third of a whorl which is completely smooth and quite different from the later postlarval female shell. This part of the shell is identical with that of a very young male, and may possibly indicate that the specimens pass through a more or less male phase. Warén (1980b) sectioned a very young solitary specimen that did not show any sexual characteristics in the anatomy. Therefore, we believe that this difference in postlarval sculpture reflects evolution from earlier protandrous hermaphroditism.

Trochostilifer ***hawaiiensis***
Warén, B. Burch & T. Burch, spec. nov.

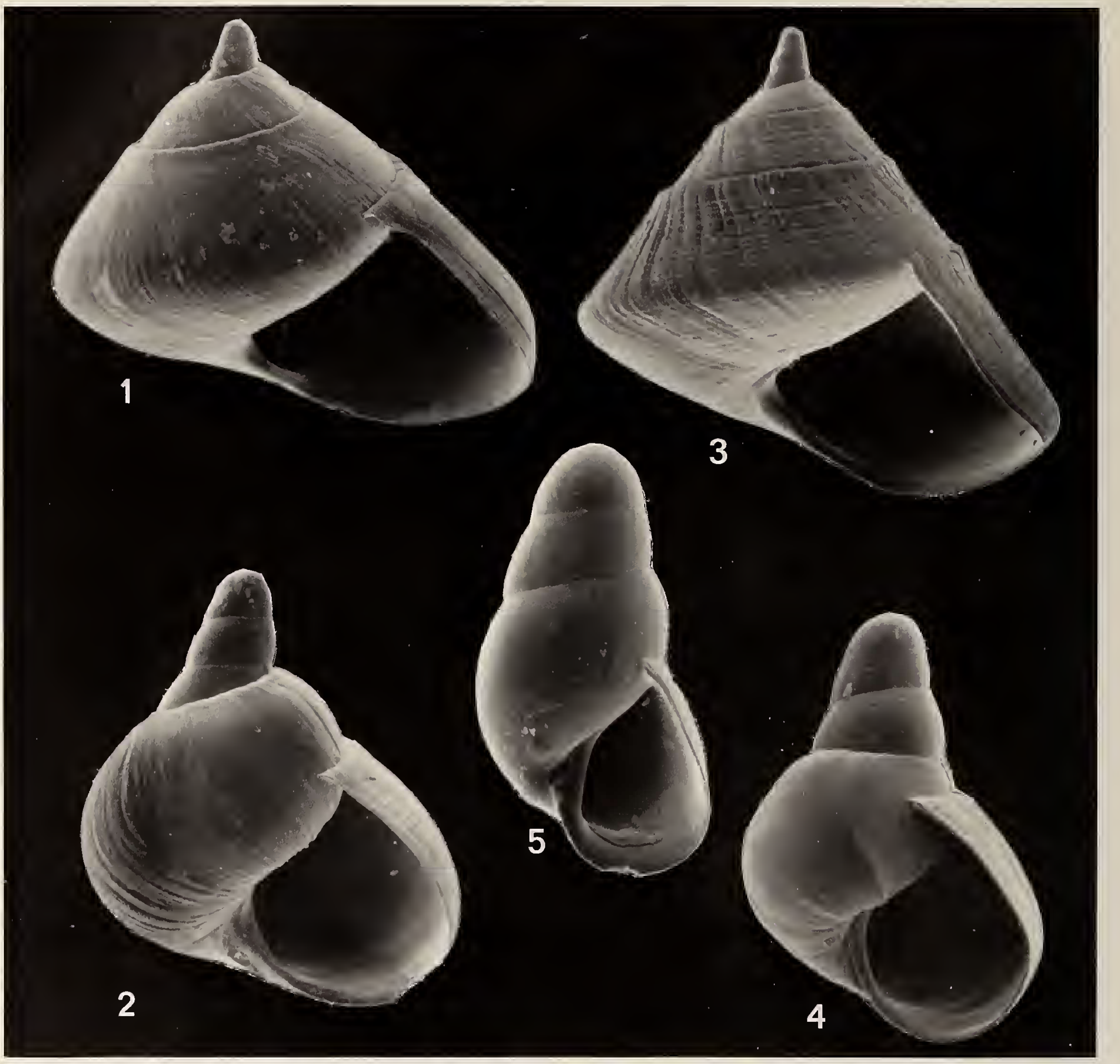
(Figures 1, 2, 7, 9, 10, 20)

Type material: Holotype, a female, USNM 792376; paratype, a male, USNM 792377.

Type locality: From a gall in the test of *Prionocidaris hawaiiensis* (A. Agassiz), 18 Sept. 1980, 21°34.1'N, 157°49.3'W, 72 m, off Kaoio, Oahu, Hawaiian Islands.

Material examined: The type specimens, from 1 gall and: 1 female, 2.6 mm, 1 male, 1.48 mm, 17 egg capsules in another gall from the same host species and the type locality.

Description—Female: Shell small, grayish transparent, broadly conical, with a rounded base and styliform larval shell. The larval shell (Figure 20) is about 450 μm high (measured from the intersection of its outer lip and the first postlarval whorl), consists of about 3.2 almost flat whorls, and is very obliquely inserted. The holotype has a little more than 2.5 postlarval whorls, which are very slightly convex. The suture is rather deep and distinct, slightly channeled and made more distinct by the subsequent whorl joining at a right angle. The sculpture con-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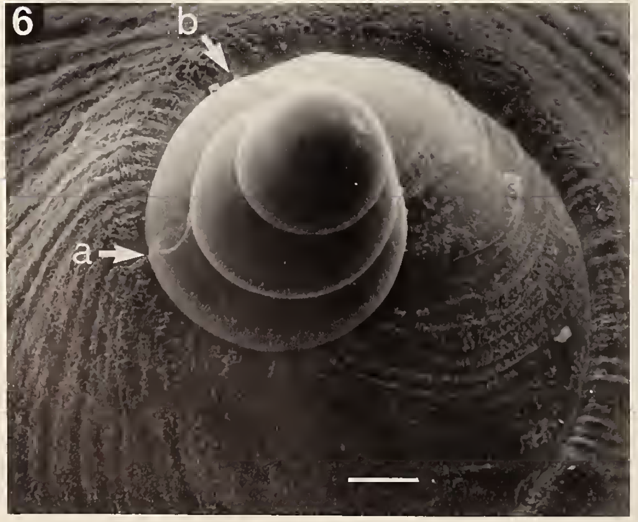
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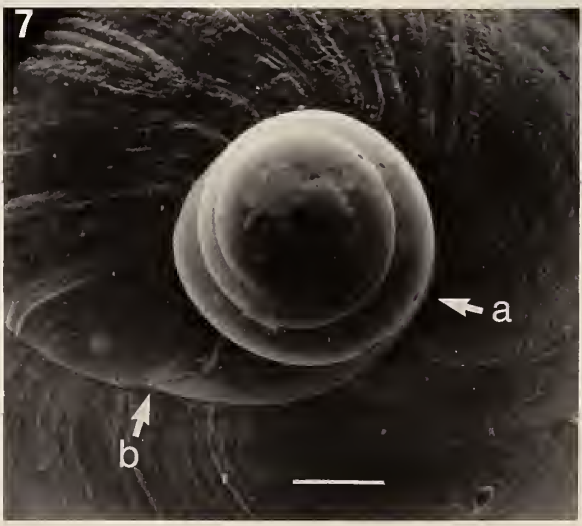
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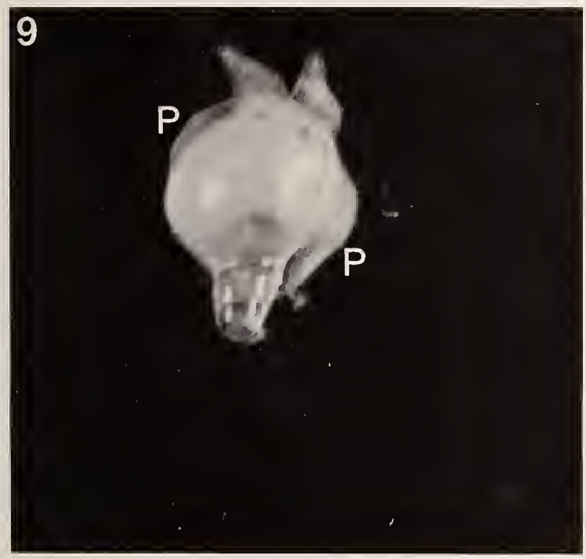
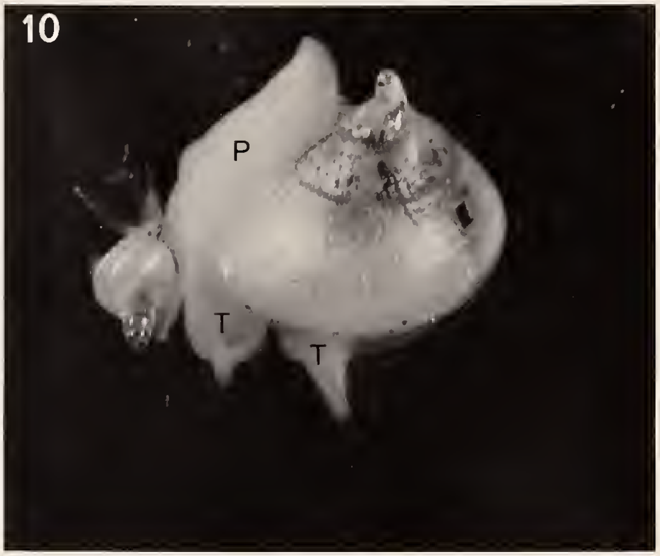
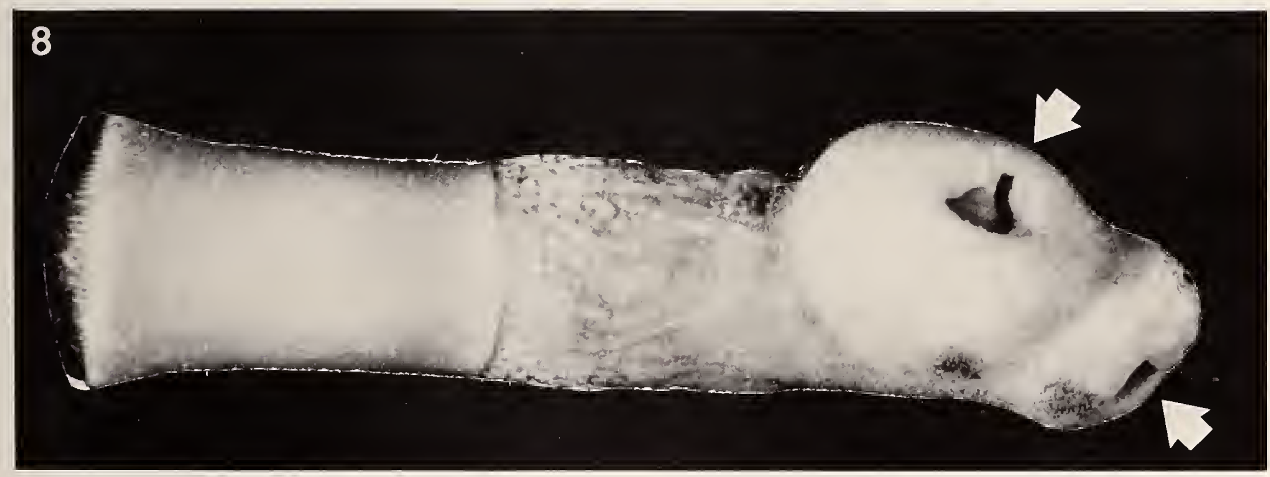






Explanation of Figures 8 to 10

Figure 8. *Trochostilifer* ***entospinea***, galls (openings indicated by arrows) in spine of *Chondrocidaris gigantea*. Total length of spine 20.5 mm.

Figure 9. Male of *T.* ***hawaiiensis***, crawling, × 21.

Figure 10. Female and male of *T.* ***hawaiiensis***. P, pedal fold; T, tentacle. × 10.

sists of distinct, sharp, close-set incremental lines of varying strength. There is also a spiral sculpture, more distinct on the basal surface, of broad but very indistinct ribs (more visible in light that shines parallel to the surface of the shell). The periphery of the body whorl is evenly rounded, leaving the distinctly convex basal surface without any sharp demarcation. The aperture is rather rounded. Seen from the side, the outer lip is very slightly flexuous.

←

Explanation of Figures 1 to 7

Figure 1. *Trochostilifer* ***hawaiiensis***. Adult female diameter 3.0 mm.

Figure 2. *T.* ***hawaiiensis***. Adult male, height 0.86 mm.

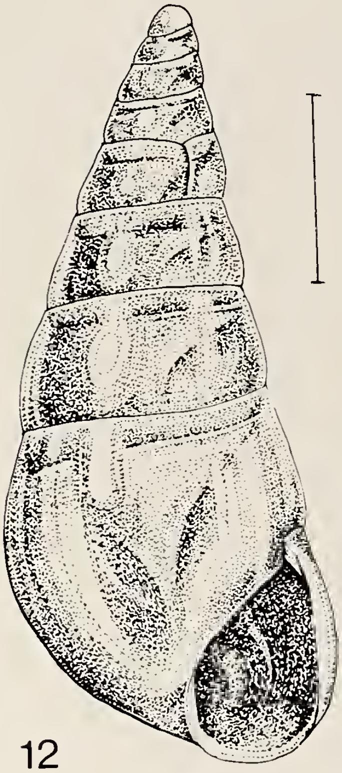
Figure 3. *T.* ***entospinea***. Adult female, diameter 2.5 mm.

Figure 4. *T.* ***entospinea***. Adult male, height 1.42 mm.

Figure 5. Newly settled *T.* ***entospinea***, height 0.62 mm.

Figure 6. *T.* ***entospinea***, apex. Scale line = 0.1 mm.

Figure 7. *T.* ***hawaiiensis***, apex. Scale line = 0.1 mm. In Figure 6 and 7, a indicates the transition from planktotrophic to benthic life, b the change to typical female growth.



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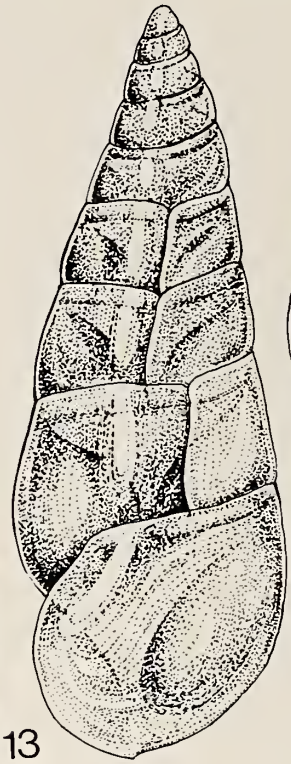

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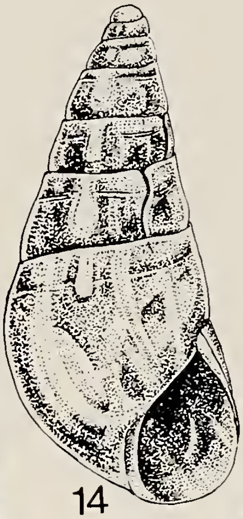

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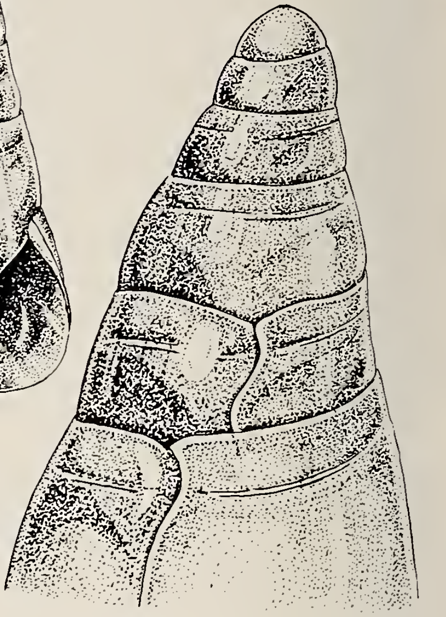

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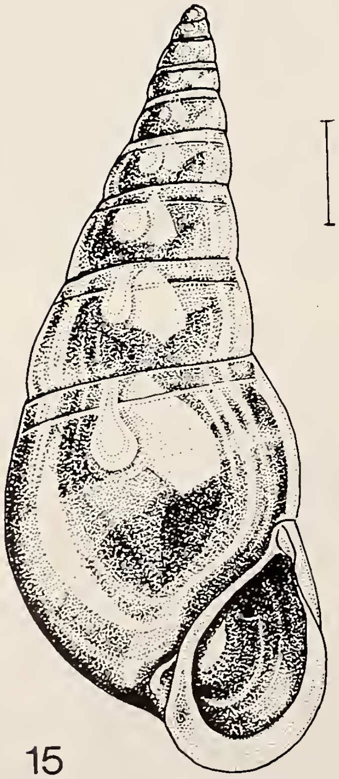

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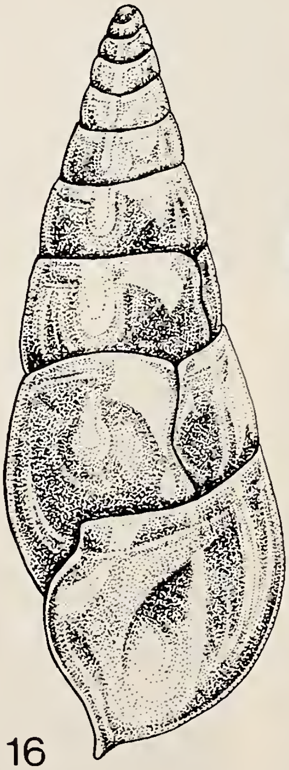

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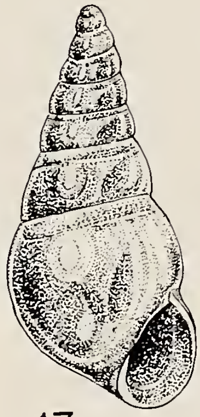

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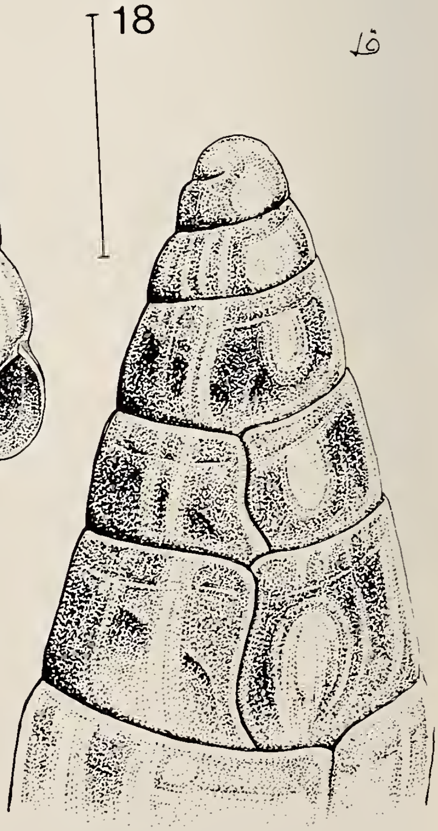

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Dimensions of holotype: Height of the shell 2.30 mm, maximum diameter 2.48 mm, minimum diameter 2.12 mm.

Male: Much smaller, maximum height 1.56 mm, shell evenly rounded and almost without a trace of spiral sculpture.

Soft parts: The male (Figures 9, 10) has a functional foot, large flat, rather pointed tentacles with eyes placed centrally in their bases. One large epipodial fold from each side of the foot covers the base of the shell. Proboscis probably retractile, because it could not be seen when the male was crawling. The female (Figure 10) has flat, squarish tentacles, the tips of which very abruptly become more slender and with small, black eyes (diameter 60 μm when preserved) centrally in the base of the tentacle. The right epipodial fold is much larger than the left. The foot is small but evidently functional and equipped with an operculum. The proboscis of living females was not observed.

Reproduction: One gall with a female of 2.6 mm height and a male contained 17 egg capsules. Each capsule has a short stalk, a smooth, simple wall and is evenly rounded with a diameter of 0.8 mm (uncleaved eggs) to 1.2 mm (veligers ready to hatch). The capsules contain about 150 eggs each. The diameter of the eggs is about 120 μm; the height of the shell of the veligers about 180 μm. The size of the veligers compared to the size of the larval shell clearly indicates that *T.* ***hawaiiensis*** has planktotrophic larval development.

Remarks: *T.* ***hawaiiensis*** resembles *T. mortenseni* Warén, 1980 in having a very faint spiral sculpture, but that species has flatter whorls and a suture that is less well marked than *T.* ***hawaiiensis.***

Vitreolina Monterosato, 1884

Type species: *Eulima incurva* Renieri in Bucquoy, Dautzenberg & Dollfus, 1883, subsequent designation, Bucquoy, Dautzenberg & Dollfus, 1898.

Remarks: The type species is probably a parasite of some ophiuroids, and originates from the Mediterranean. We are convinced that the two species described below do not belong to *Vitreolina* but should be classified in a new genus; lack of soft parts has made us hesitate to describe a new genus for them. We have, therefore, placed them in *Vitreolina* provisionally, because of some similarity in shell characters.

Vitreolina ***hawaiiensis***

Warén, B. Burch & T. Burch, spec. nov.

(Figures 15, 16, 17, 19)

Type material: Holotype (a female) USNM 792381 and a paratype (a male) USNM 792382.

Type locality: Found on *Prionocidaris hawaiiensis,* 18 Sept. 1980, 21°34.1′N, 157°49.3′W, 72 m, off Kaoio, Oahu, Hawaiian Islands.

Material examined: The type material and: 1 female, 2.20 mm, from *Prionocidaris hawaiiensis,* 8 Sept. 1980, 21°33.5′N, 157°49.0′W, 72 m.

Description—Female: Shell small, conical, slightly curved, vitreous and slender, with numerous, slowly increasing whorls. The larval shell consists of a little more than 3 whorls and its height is 450 μm. Its whorls are colorless, perfectly transparent, and very slightly convex. The holotype has 5.5 postlarval whorls which are almost flat, except for the body whorl which is quite inflated. The suture is very indistinct and the false suture (the line marking the internal connection of the whorls) is much more conspicuous. There are 4 incremental scars after the one that marks the connection of the larval and postlarval shells, placed slightly more than one whorl apart. The last of these scars marks the point where the whorls become inflated. The aperture is low and rounded, distinctly broader in its lower part. Seen from the front, the outer lip is slightly flexuous; seen from the side it is retracted at the suture, strongly projecting below this, then retracted again, in its lower part. The most projecting part is situated just above the upper third.

Dimensions of holotype: Height of the shell 3.48 mm, diameter 1.40 mm, height of the aperture 1.04 mm, breadth 0.60 mm.

Male: Shell smaller (1.8 mm high), body whorl not inflated.

Soft parts: Not studied, but the general coloration of the live animal is evenly yellowish to reddish brown.

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Explanation of Figures 12 to 19

Figures 12, 13. *Vitreolina* ***chondrocidaricola***, female.

Figure 14. *V.* ***chondrocidaricola***, male, drawn at the same scale.

Figures 15, 16. *V.* ***hawaiiensis***, female.

Figure 17. *V.* ***hawaiiensis***, male, drawn at the same scale.

Figure 18. *V.* ***chondrocidaricola***, apex.

Figure 19. *V.* ***hawaiiensis***, apex. The uppermost labial scars in Figures 18 and 19 mark the change from planktonic to benthic life.

Scale lines: Figures 12 to 17, 0.5 mm; Figures 18 to 19, 0.25 mm.

Remarks: The specimens were found on the spines and test of the host. The precise nature of the parasitism is not known and because of the small number of specimens, we did not want to break a shell to examine the soft parts.

Vitreolina **chondrocidaricola**
Warén, B. Burch & T. Burch, spec. nov.

(Figures 12, 13, 14, 18)

Type material: Holotype (a female) USNM 792383 and 8 paratypes USNM 792384.

Type locality: From the intestine of *Chondrocidaris gigantea,* 9 Dec. 1979, 21°25.8′N, 157°43.3′W, 15 m, Kailua Bay, Oahu, Hawaiian Islands.

Material examined: The type material and: 3 specimens, from spines of *C. gigantea,* 13 Jan. 1980, 21°28.0′N, 157°43.0′W, 23 m, Maku Manu, Oahu, Hawaiian Islands, USNM 792385; 2 specimens from dorsal spines of *C. gigantea,* 3 Feb. 1980, 21°20.5′N, 158°08′W, 23 m, Kahe Point, Oahu, Hawaiian Islands, USNM 792386; 39 specimens from spines, 6 young and crushed specimens from coelomic cavity of *C. gigantea,* 10 Feb. 1980, 21°25.8′N, 157°43.3′W, 18 m, Kailua Bay, Oahu, Hawaiian Islands; 8 specimens from dorsal spines of *C. gigantea,* 9 March 1980, Pilokahe Point, Oahu, Hawaiian Islands, 18 m, USNM 792387.

Description—Female: Shell small, colorless, transparent, rather broadly conical, straight or slightly curved. The larval shell consists of about 4 slightly convex, colorless whorls with a distinct suture. The height is about 480 μm. The holotype has 4 postlarval whorls, which are less convex than the larval whorls, perfectly smooth and with a false suture more distinct than the real suture which is shallow and inconspicuous. There are 3 incremental scars in the holotype, at intervals of a little more than 1.0 whorls. The aperture is low and rounded, deeply excavated in its lower part. The outer lip is retracted at the suture and evenly curved and projecting below this with its most protruding part situated at the midpoint of its height (seen from the side).

Dimensions of holotype: Height of the shell 2.10 mm, diameter 0.86 mm, height of the aperture 0.64 mm, breadth 0.40 mm.

Male: Half the size of the female and with correspondingly fewer whorls.

Soft parts: Not studied, but from a photograph it can be seen that the animal has rather long, cylindrical tentacles with black eyes at the base, a functional, small and short foot, and patchy, brownish pigmentation.

Remarks: *V.* **chondrocidaricola** can be separated from *V.* **hawaiiensis** by its less projecting outer lip and less inflated body whorl.

There are a few species of eulimids known that resemble the two species of *Vitreolina* described here, but no Indo-Pacific ones. The small size, pointed larval shell, and low, rounded aperture make them easily distinguishable from other eulimids. Another helpful detail is the suture, which is distinctly curved just in front of, and after, the incremental scars.

Pelseneeria Koehler & Vaney, 1908

Type species: *Pelseneeria profunda* Koehler & Vaney, 1908, subsequent designation Winckworth, 1932.

Remarks: The species of *Pelseneeria* are ectoparasites on regular sea urchins. Most of them crawl around on the test, presumably feeding on the epithelium or introducing the proboscis into the tube feet to suck body fluid. One previously known species (SCHEPMAN & NIERSTRASZ, 1909, as *Stilifer* sp.), from *Aspidodiadema tonsum* A. Agassiz, is known to be permanently attached, with its proboscis introduced into a gonad of the host.

Pelseneeria sp.

In the collections of the Division of Mollusks, USNM, there is a pair of specimens of *Pelseneeria,* from U.S. Fisheries Commission (USFC) "Albatross" Station 4044, 1902, off Kawaihae Light, W coast of Hawaii, 356–520 m.

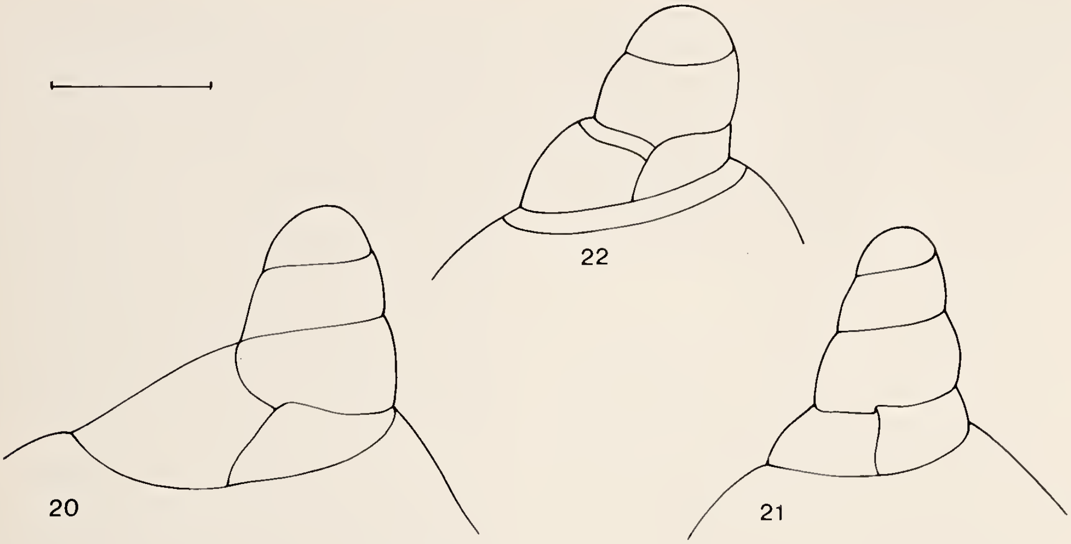
The shells have been completely dissolved by acidic alcohol, but the soft parts seem to be well preserved. Nothing is mentioned about hosts. In AGASSIZ & CLARK's (1908) report on the Echinoidea from these dredgings, there is mentioned only a single species of echinoid from the station mentioned above, *viz. Stereocidaris grandis* (Döderlein). MORTENSEN (1928:22–23) disagreed with this identification and regarded this specimen as a distinct species, *Stereocidaris hawaiiensis* Mortensen, 1928. He also mentioned that the specimen in question had gastropod egg capsules attached at the periproct. The specimen is still in the collections of the Division of Echinoderms, USNM 27334. Examination of the specimen revealed 9 egg capsules attached to the test, but no enlarged gonopores were noticed, although the dorsal part of the test was cleaned of spines. It can, therefore, be assumed that these two specimens represent a second Hawaiian species of *Pelseneeria,* parasitic on *Stereocidaris hawaiiensis,* in addition to *P.* **hawaiiensis.** We will, however, not name it here, because the absence of the shell would complicate future identification.

Pelseneeria **hawaiiensis**
Warén, B. Burch & T. Burch, spec. nov.

(Figures 22, 25, 26)

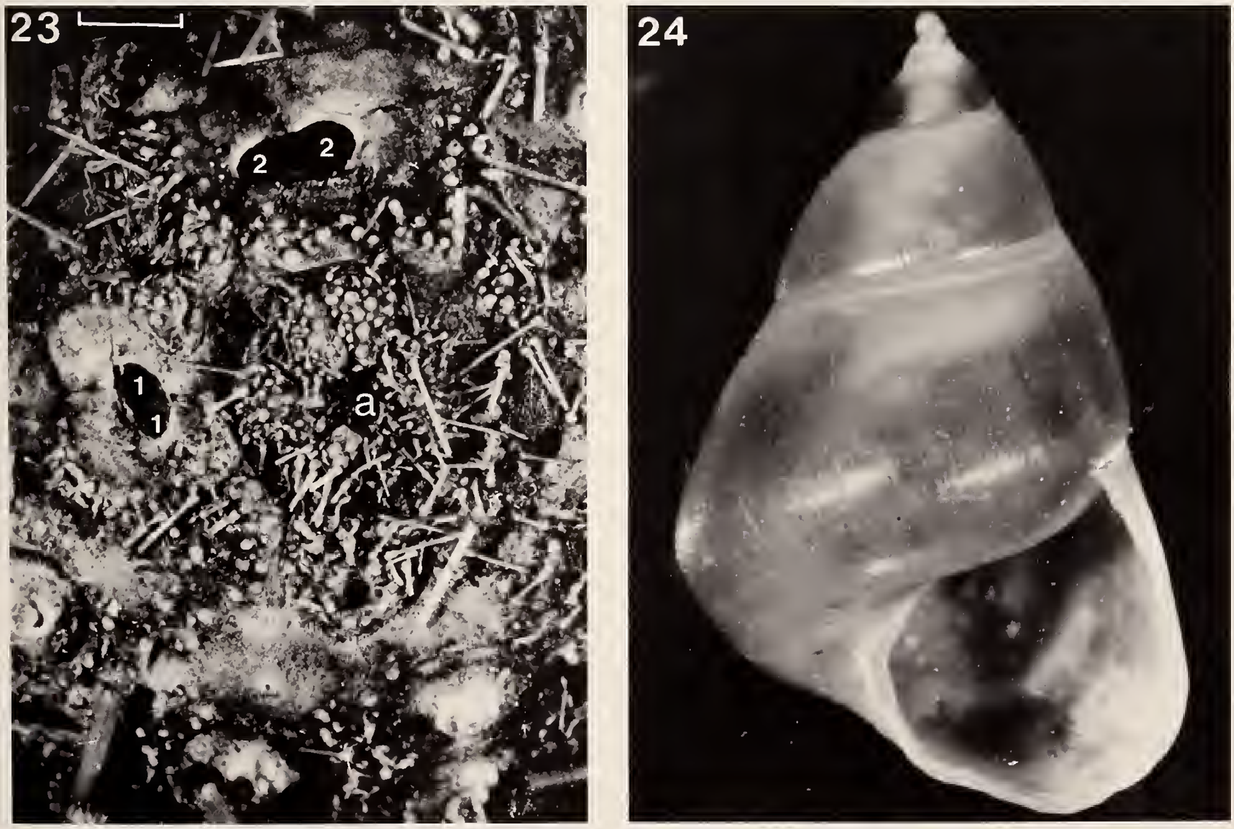
Type material: Holotype USNM 111067 and 2 paratypes, USNM 792380.

Type locality: Attached by the proboscis (which is introduced through the gonopore) on a specimen of *Aspidodi-*



Explanation of Figures 20 to 22

Figures 20 to 22. Apices. Figure 20. *Trochostilifer* ***hawaiiensis***. Figure 21. *T.* ***entospinea***. Figure 22. *Pelseneeria* ***hawaiiensis***. Scale line = 0.25 mm.



Explanation of Figures 23 and 24

Figure 23. Aboral part of *Aspidodiadema hawaiiense* (USNM 111067) with holes from proboscides of *Pelseneeria* ***hawaiiensis***. a, anus of the sea urchin; 1,1 and 2,2 show the positions of the individual proboscides of the two pairs of parasitic snails. Scale line = 2 mm.

Figure 24. *Pelseneeria* ***hawaiiensis***, holotype, 5.64 mm high.

adema hawaiiensis (Mortensen), USFC "Albatross" Station 3865, Pailolo Channel, Hawaiian Islands, 500 m.

Material examined: The type material and: 2 specimens, 5.04 and 2.40 mm high, attached as above, on *Aspidodiadema hawaiiensis,* 11 Nov. 1979, 21°14.4′N, 157°56.6′W, 470 m, Mamala Bay, Oahu, Hawaiian Islands; (4 specimens reported by Agassiz & Clark (1908), USFC "Albatross" Station 3839, off Lae-o, Ka Laau Light, Molokai, Hawaiian Islands, 570–580 m and their host were examined, but only fragments remained).

Description: Shell yellowish to brownish, rather thin and fragile, rather broadly conical, with a blunt mucronate larval shell. The larval shell (Figure 22) consists of about 2 slightly convex whorls and its axis forms a distinct angle with that of the postlarval whorls. The holotype has 4.0 postlarval whorls, sculptured with faint incremental lines and 3 irregularly placed and indistinct incremental scars. The whorls are slightly convex and the suture is shallow but distinct. The subsutural zone occupies about $\frac{1}{12}$ of the height of the whorls. The periphery of the whorls is more angulated than rounded, which gives the base of the shell a rather flat appearance. The aperture is rather large and evenly rounded in its lower part. The columella is thin and the parietal wall is not covered by a callus.

Dimensions of holotype: Height of the shell 5.64 mm, diameter 3.40 mm. Height of the aperture 2.47 mm.

Soft parts: Typical for *Pelseneeria,* but eyes are lacking. The specimens did not leave the host when disturbed, but had to be pulled off the host. The animal is unpigmented. The proboscis is introduced through the gonopore which becomes enlarged (*cf.* Figure 23). The part of the proboscis which is inside the gonad is greatly enlarged by being filled with and inflated by the body-fluid of the parasite, thereby probably functioning as an anchor and keeping the snail in position on the host. The damage of the gonopore also indicates that the snail is permanently attached to the same gonopore.

Remarks: Schepman & Nierstrasz (1909) never named "*Stilifer* sp." from *Aspidodiadema tonsum* because the shell was broken. It is, therefore, not possible to say whether their specimen belonged to a different species. The mode of parasitism, being attached to the gonopores, distinguishes their species and *P.* ***hawaiiensis*** from all other known species of *Pelseneeria.*

All specimens examined occurred in pairs, presumably to ensure contact for copulation.

The present species was first reported on by Agassiz & Clark (1908) in their treatment of the echinoids taken by the USFC in Hawaii. They had found four specimens on one host (of which one pair can be seen on their plate 58, fig. 7), determined *Aspidodiadema meijeri* A. Agassiz & Clark (sic; the correct author is Döderlein). Mortensen (1939), however, after having examined their specimens regarded them as a distinct species and described it as *Aspidodiadema hawaiiensis* Mortensen, 1939.

Agassiz & Clark (1908) noticed that the genital plates on which the snails were attached had more numerous spines than the other genital plates. Their observation was based on two parasitized genital plates; but, if this tendency is persistent, the modification is certainly adaptive for the parasite, giving better protection from grazing fishes.

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